

REMARKS

Claims 1, 2, 4, 6, 8, 9, and 11-16 are pending in the Application.

Status of Office Action

In an earlier conversation with the Examiner on November 4, 2009, the Examiner clarified that the current Office Action was mistakenly marked as Final on page 10, section 16. Per the Examiner's suggestion from the above conversation, Applicants note here that the Office Action is properly Non-Final after a Request for Continued Examination, and is treated as such for the purposes of this Amendment.

Specification

By this Amendment, Applicants amend the specification to correct a clerical error in paragraph [0073], which mistakenly refers to "six" semiconductor elements when "five" was intended, as in paragraph [0072].

Claim Rejections - 35 U.S.C. § 103

Claims 1, 2, 4, 6, 8, 9 and 11-16 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Qi (US 6774497) taken with Fujimori (US 2004/0046252 A1). Applicants respectfully traverse.

By this Amendment, Applicants amend claims 1 and 6 to recite that the solder resist overlaps the pads in a Solder Mask Defined (SMD) structure. Applicants submit that this amendment is supported at least at Figs. 2 and 6.

Applicants submit that Qi teaches a device of a non-SMD structure, as seen at least at Qi Fig. 2B. Qi does not disclose a device of "an SMD structure wherein the volume of said bumps is less than the volume of said apertures", which is a feature of the presently claimed subject matter.

In the Office Action, the Examiner cites to col. 7, lines 14-32 as allegedly teaching an embodiment in which the volume of the bumps is less than the volume of the apertures. Applicants submit that neither this embodiment, nor any other embodiment taught in Qi, teaches a semiconductor device including both an SMD structure and bumps with volume less than that of the apertures. Applicants note that the cited embodiment teaches bumps with a radius of 3.15 mils, and pads 242 which are 5 mils in diameter. By the Examiner's admission on page 3 of the Office Action, an aperture of the solder mask must have a minimum width of 6.3 mils in order to accommodate a solder ball having a radius of 3.15 mils. Therefore, an aperture in the solder mask 250 of this embodiment of Qi must be larger than the pad 242, and therefore does not overlap with the pad in an SMD structure. Applicants submit that the other embodiments taught in Qi are similarly non-SMD in structure.

Qi refers to the SMD structure only in column 6, pages 65-67, as a possibility for the solder mask 250. However, Qi fails to teach using such an SMD structure wherein the volume of bumps is less than the volume of apertures. Applicants further submit that Fujimori fails to cure this deficiency.

Employment of an SMD structure has the following advantages:

First, since a solder resist 7 covers the peripheral areas of an electrode pad 5, wetting of the electrode pad 5 by a bump 3 is not widely spread due to the presence of the solder resist 7. Since the peripheral areas of the electrode pad 5 are not covered by the bump 3, stress does not act on the edges of the electrode pad 5 when a semiconductor device according to the claimed subject matter is mounted. As convergence of stress on a specific area can be reduced, peeling of the electrode pad 5 and cracks on a wiring board 1 can be prevented. A semiconductor device according to the claimed subject matter therefore affords high connection reliability.

Secondly, when a plurality of the electrode pads 5 are connected with each other by wires, the solder resist 7 entirely covers the wires, including connection portions between the electrode pads and the wires, in the SMD structure. As the wires are highly protected, the connection reliability is high in the claimed subject matter.

In view of the above, Applicants submit that claims 1 and 6 are patentable over the cited art, and that claims 2, 4, 8, 9 and 11-16 are patentable at least by virtue of their respective dependencies.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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